

D R A F T

Groundwater Monitoring Plan

for the

Incinerator Spray Pond

Radford Army Ammunition Plant
Radford, Virginia

Prepared By: Environmental Resources Management, Inc.

For

Alliant Techsystems, Inc.
Radford Army Ammunition Plant
Radford, Virginia

Updated June 23, 1995

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1.0

INTRODUCTION

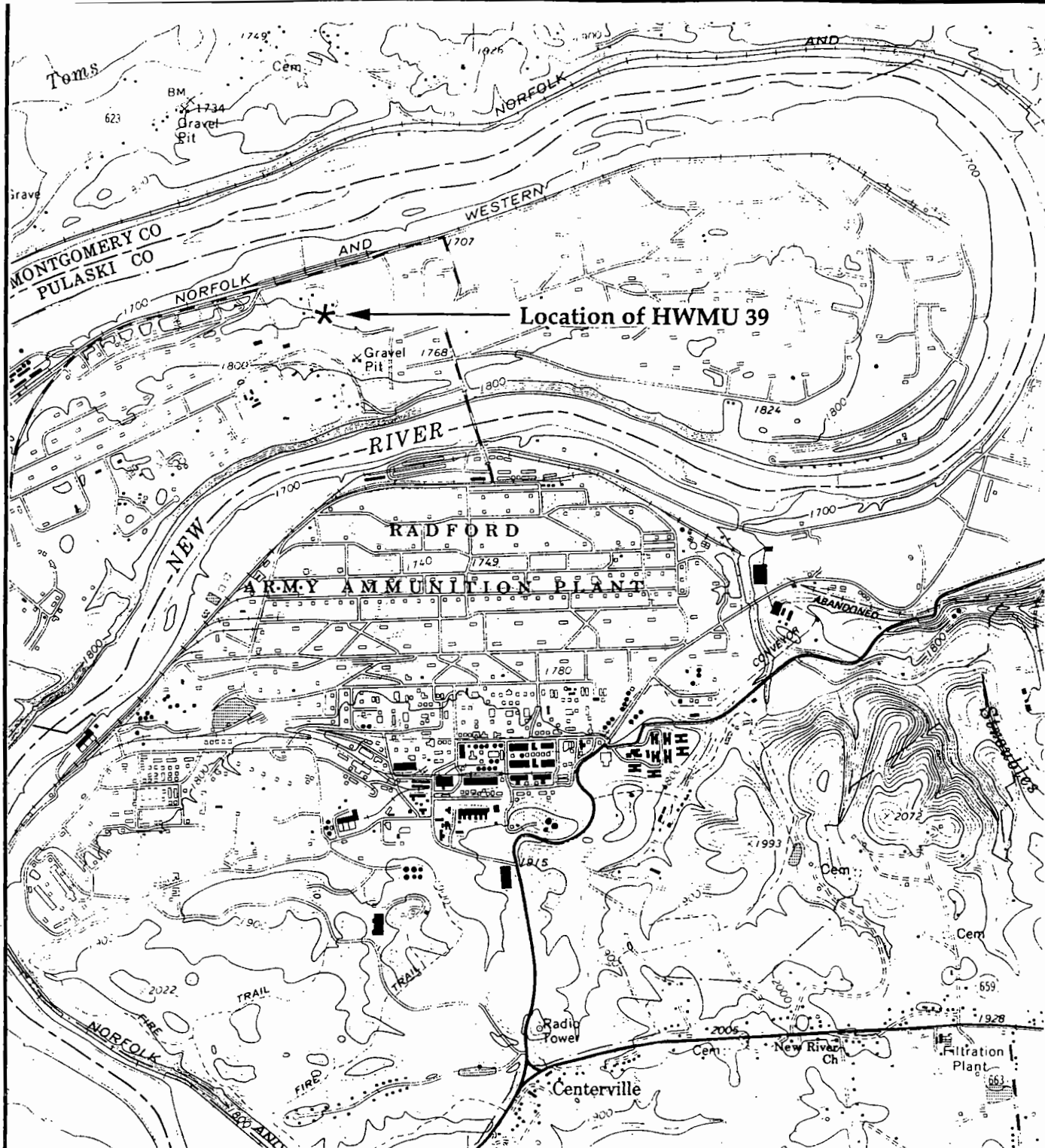
The Radford Army Ammunition Plant (RAAP) is under an Enforcement Order, effective 22 June 1993, to close the Incinerator Spray Pond (EPA ID No. VA1210020730). The closure includes a ground water monitoring program as specified in the Virginia Hazardous Waste Management Regulations (VHWMR) § 9.5 and modified as necessary to meet § 10.10.I.1.a. This Ground Water Monitoring Plan (Plan) was designed in accordance with the USEPA RCRA Ground Water Monitoring Technical Enforcement Guidance Document, USEPA Guidance on Remedial Actions for Contaminated Ground Water at Superfund Sites, and the USEPA Test Methods for the Evaluation of Solid Waste, Physical/Chemical Methods (SW-846), to meet the performance standards specified for a Detection Ground Water Monitoring Program pursuant to VHWMR § 9.5.

1.1

SITE DESCRIPTION

The RAAP is located in the mountains of southwest Virginia within Pulaski and Montgomery Counties. A Site Location Map is presented as **Figure 1**. The facility is situated in one of a series of narrow valleys typical of the Valley and Ridge physiographic province of the Appalachian Highland Region of North America. Oriented in a northeast-southwest direction, the valley is approximately 25 miles long. The valley has a width of approximately eight miles at the southwest end and narrows to approximately two miles at the northeast end. RAAP lies along the New River in the relatively narrow northeast corner of the valley. The maximum elevation at RAAP is 2,225 feet above mean sea level (MSL) in the southeast corner and the minimum elevation is approximately 1,700 feet above MSL along the New River. RAAP is divided by the New River into two sections. The southern section, which comprises approximately two-thirds of RAAP, is called the "Main Plant." The remaining northern one-third section is called the "Horseshoe Area." The Incinerator Spray Pond (one section of HWMU 39) is located in the Horseshoe Area (**Figure 1**).

HWMU 39 consists of a concrete-lined aeration pond (Incinerator Spray Pond) and two unlined earthen ponds (**Figure 2**). This Plan specifically addresses the concrete-lined aeration pond; the two unlined earthen ponds are currently monitored by EPA Region III under a separate plan. The Incinerator Spray Pond serves as a cooling pond for incinerator scrubber and cooling water from the Hazardous Waste Incinerator (HWMU 14). The Incinerator Spray Pond is located approximately 1,100



Source: USGS Radford North, Virginia 7.5 minute Topographic Quadrangle Map, 1984.
 Scale: 1 inch = 2000 feet.

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Figure 1
Site Location Map
 HWMU 39
 Radford Army Ammunition Plant
 Radford, Virginia

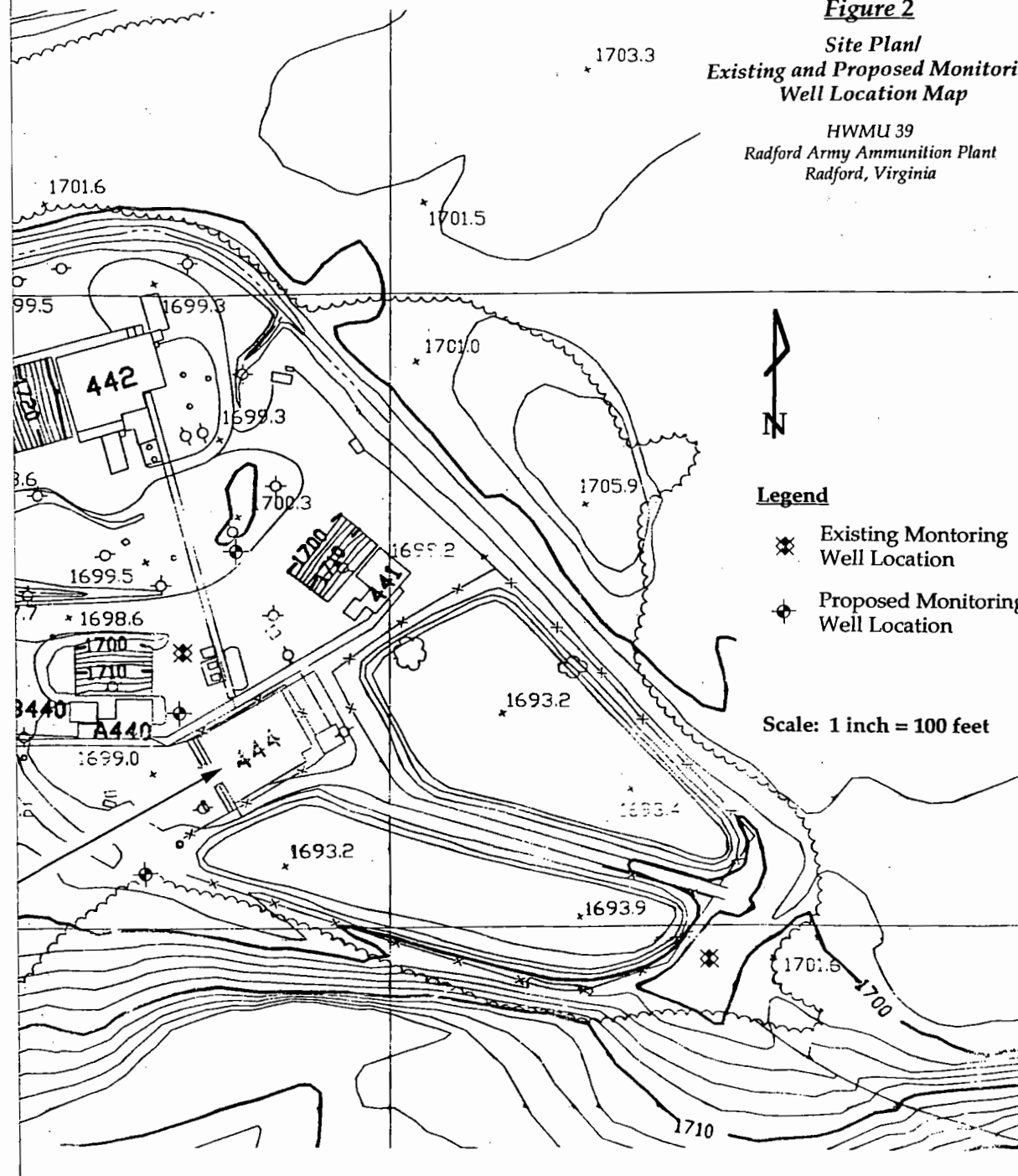


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Figure 2
Site Plan/
Existing and Proposed Monitoring
Well Location Map

HWMU 39
 Radford Army Ammunition Plant
 Radford, Virginia



feet from the New River, on the edge of a nearly level river terrace that slopes gently north toward the river. The approximate elevation of the unit is 1,700 feet above MSL. The approximate elevation of the New River in this area is 1,675 feet above MSL.

1.2

GEOLOGIC/HYDROGEOLOGIC FRAMEWORK

The general geology at RAAP consists of limestone/dolomite bedrock that is covered by alluvial deposits locally exceeding 50 feet, but averaging about 20 feet in thickness. These alluvial deposits consist of typical fluvial deposits of interbedded clay, silt, and sand/gravel deposits with cobble lenses. Underlying the alluvium is a series of dolomite, limestone and shale strata known as the Cambrian-aged Rome and Elbrook Formations. The Rome Formation is heterogeneous, and is comprised of both clastic and carbonate rocks. The Elbrook Formation is typically a thick blue-gray limestone. The Elbrook Formation is the major outcropping formation as well as the predominant karstic formation below the facility. The Rome Formation is predominant in the Horseshoe Area, whereas the Elbrook is predominant south of the New River.

The general hydrogeologic setting for RAAP is characterized by porous alluvial sediments overlying weathered and unweathered dolomite and limestone. In areas where the porous alluvial sediments are the uppermost water-bearing zone, ground water flow is generally from topographically high areas to topographically low areas. However, in some areas of RAAP the uppermost water-bearing zone is within the bedrock. The bedrock water-bearing units show moderate to mature karst development. This karst development is evidenced by the occurrence of: sinkholes, solution channels along fractures and bedding planes, pinnacle surfaces, and vugs. These karst features can act as conduits for ground water flow, increasing flow rates, and in some cases, redirecting flow away from the expected flow direction. The upper portion of the weathered bedrock consists primarily of residual clay and clast deposits.

According to previous studies conducted within the Horseshoe Area of RAAP, the water table within the flood plain is approximately the same elevation as the surface water of the river. Assuming that the uppermost water-bearing zone beneath the Incinerator Spray Pond is within the porous alluvial sediments, it would be expected that ground water beneath the subject site flows roughly north toward the New River.

2.0

GROUND WATER MONITORING NETWORK

2.1

GROUND WATER MONITORING WELL LOCATIONS

The initial ground water monitoring system for the Incinerator Spray Pond will consist of five (5) ground water monitoring wells. Two (2) of the five wells that will comprise the initial monitoring system were previously installed to monitor the two unlined earthen ponds. The locations of these two existing monitoring wells are illustrated on **Figure 2**. The well located to the southeast of the ponds will serve as an upgradient location and will be used to establish background ground water concentrations. After the first year of quarterly monitoring to determine background ground water concentrations, this upgradient well will no longer be sampled as part of the monitoring plan for the Incinerator Spray Pond; the final ground water monitoring system for the site will consist of four (4) monitoring wells following the first year of monitoring. The remaining existing well is located to the northwest of the ponds will serve as a downgradient monitoring well. Boring logs and well construction details for these two wells were not available at the time this Plan was written, but will be forwarded to the Virginia Department of Environmental Quality (VADEQ) when the information is available.

The proposed locations for the remaining three monitoring wells are illustrated on **Figure 2**. One well will be installed to the southwest of the concrete-lined Incinerator Spray Pond to serve as the primary upgradient location. The proposed well located to the north of the western corner of the concrete-lined pond will serve as an additional downgradient well, and the proposed well located approximately 120 feet north of the concrete-lined pond will serve as a downgradient well as well as the unit compliance point.

Following the installation of the three proposed wells, the information collected during well installation will be incorporated into an Addendum to the Ground Water Monitoring Plan. This Addendum will include field notes, boring logs, well construction diagrams, aquifer test results, and any other information collected during ground water monitoring well installation. The Addendum will be submitted to the VADEQ within 30 days following the installation of the three proposed monitoring wells.

2.2

GROUND WATER MONITORING WELL INSTALLATION

The three proposed monitoring wells will be installed by Virginia Department of Professional and Occupational Regulation certified drillers. The three wells will be installed to the first saturated zone in accordance with the most recent available edition of the RCRA Ground Water Monitoring Technical Enforcement Guidance Document (1986). Based on the local topography, it is assumed that the wells will be installed to a depth of approximately 30 to 35 feet below grade, and constructed such that the screened intervals intersect the water table.

2.2.1

Soil Boring and Sampling Procedures

The soil borings will be advanced initially using a drill rig equipped with 4.25-inch inside diameter (I.D.) or larger hollow-stem augers. However, in the event that auger refusal is encountered prior to reaching the uppermost water-bearing zone, the borings will be completed using air rotary drilling equipment. All soil cuttings produced during drilling operations will be containerized in 55-gallon Department of Transportation (DOT)-approved steel drums and stored at a central location on-site pending characterization and proper disposal.

Soil samples will be collected at five-foot intervals until boring termination, if possible, using the split-spoon method (ASTM D1586). Each soil sample will be logged in the field by an on-site Project Geologist. Soil types will be identified by the Project Geologist and will be reported in accordance with the Unified Soil Classification System (ASTM D2488). The Project Geologist will note all field observations in a bound field logbook. Each soil sample will be field screened for total volatile organic vapors upon collection using an Organic Vapor Analyzer (OVA) or a Photoionization Detector (PID) for health and safety purposes. The results of the field screening will be included in the field logbook and on each boring log. An example boring log is included as **Figure 3**. In addition, one soil sample will be collected from above the saturated zone in each boring and submitted for laboratory analysis for cation exchange capacity.

2.2.2

Monitoring Well Construction

Upon boring termination, ground water monitoring wells will be constructed within the borings. The wells will be completed approximately 10 feet below the water table. The monitoring wells will be constructed inside the augers using two-inch I.D. Schedule 40, threaded, flush-joint, polyvinyl chloride (PVC) riser pipe and machine-slotted screen. Each screen will be 15 feet in length with a number 10 slot size



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Boring /Monitoring Well Log

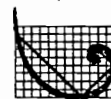
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Client:		WO#:		Boring/Well I.D.: MW-1	
Project:		Well Construction Data			
Date Started:	Date Completed:	Screen:	2" ID, 0.01"-slotted PVC	From: 7	To: 17
Logged By:	Checked By:	Pack:	Silica Sand	From: 5	To: 17
Drilling Co.:	Driller:	Seal:	Bentonite Chips	From: 3	To: 5
Method:	6.25" ID HSA	Equipment:	Grout:	Cement/Bentonite	From: 0 To: 3
Boring Depth:	17' bgl	Ground Surface Elevation:	Inner Casing: 2" ID Schedule 40 PVC		
Initial GW Level:	11' bgl	GW Level:	Time/Date:	Outer Casing/Stick Up: 8" OD Manhole	

Depth	Sample Type	Sample ID	Blow Counts	Headspace	Lithology	Description	Remarks	Well Construction
0			3-5-3-3	0.9 ppm		Yellow-brown, fine sandy SILT, dry. Mottled (yellow-brown, light brown), fine silty SAND, damp.		
5			4-5-2-3	2.1 ppm		Gray, fine SAND, moist.		
10			2-2-1-3	1.5 ppm		Becoming wet.		
15			2-3-2-2	1.3 ppm		Becoming fine to coarse SAND.		
20						Boring terminated at 17 feet. Monitoring well MW-1 installed.		
25								
30								

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Figure 3
**Example Boring Log/
Well Construction Diagram**
HWMU 39
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(0.01-inch), and placed across the water table. Approximately five feet of the screen will extend above the water table in each well.

A minimum of six inches of clean, coarse-grade silica sand filter-pack material will be placed under the bottom of the well screen to provide a firm footing. The sand-pack will be installed around the screen to approximately two feet above the top of the screen. A weighted tape will be used to help prevent bridging and ensure the proper placement of the sand-pack. A filter-pack seal consisting of a minimum of two feet of bentonite pellets or granules will be placed above the sand-pack. A weighted tape will be used to help prevent bridging and ensure the proper placement of the bentonite seal. The bentonite seal will be hydrated with two gallons of potable water and allowed to hydrate at least one hour. Following the bentonite seal hydration, the remainder of the annular space around the wellpipe will be filled with grout using a tremie pipe to a point approximately two feet below the ground surface. The grout will be a mixture of portland type cement and four to six percent powdered bentonite by weight. The final two feet of the annular space will be filled with concrete. A protective steel casing with locking cap and a two-foot by two-foot concrete surface pad will complete each well installation. Four steel pipes will be placed around each well to protect the well from incidental damage. An example of the well construction details and diagram that will be included on the boring logs for each monitoring well is included on **Figure 3**.

2.2.3 *Monitoring Well Development*

At least 24 hours after well completion, the ground water monitoring wells will be properly developed to the fullest extent practical in order to remove drill cuttings or other materials introduced during well installation. A minimum of three wetted well volumes will be removed from each well. The monitoring wells will be developed by centrifugal pumping, air surging, or other appropriate means. The wells will be developed until field measurements for pH and specific conductivity stabilize to the point that consecutive readings are within 10%, or until the water removed is visually free of suspended sediments. All development water will be containerized in 55-gallon DOT-approved steel drums and stored at a central location on-site pending characterization and proper disposal.

2.2.4 *Equipment Decontamination*

The drill rig and all downhole drilling equipment will be steam-cleaned prior to use at the site, between each boring, and prior to demobilization. The split-spoon samplers will be washed in a non-phosphate detergent

and tap water solution, followed by a tap water rinse/distilled water rinse both before and after the collection of each soil sample. The monitoring well PVC riser pipe and screen will be steam-cleaned prior to use or arrive at the site sealed in plastic from the manufacturer. Well development equipment will either be steam-cleaned or thoroughly washed with a non-phosphate detergent and tap water solution, followed by a tap water rinse/distilled water rinse before use and following the development of each well. All decontamination water produced at the site will be containerized in 55-gallon DOT-approved steel drums and stored at a central location on-site pending characterization and proper disposal.

2.2.5

Elevation Survey

After completion of the well installations, the horizontal locations and vertical elevations of the wells will be surveyed by a Virginia-licensed land surveyor. The survey crew will be Health and Safety trained in accordance with OSHA Standard 1910.120. The well elevations will be surveyed with respect to National Geodetic Vertical Datum (NGVD). The elevation of each PVC well casing will be referenced from an established and documented point on top of the PVC well casing. In addition, the ground surface elevation at each well location will be surveyed. All surveyed elevations will be measured to the nearest 0.01 feet. The elevations will be included on the boring logs.

2.3

DETERMINATION OF AQUIFER CHARACTERISTICS

At least 48 hours after well development, static ground water levels will be measured in the six ground water monitoring wells using an electronic water level indicator. All water level measurements, including total well depth measurements, will be referenced from an established and documented point on the top of the PVC well casing. The static water level measurements will be correlated with the surveyed monitoring well elevations to provide ground water elevations for the site.

Slug tests will be conducted on the three new ground water monitoring wells in order to determine the hydraulic conductivity of the aquifer if the wells are screened within the porous alluvial sediments. A properly decontaminated PVC or stainless steel slug will be utilized to facilitate instantaneous water-level changes in the wells. A pressure transducer system with a digital data logger will be used to collect the slug test data. The data will be down loaded to a computer and reduced utilizing automated curve matching procedures. The resulting hydraulic conductivity, along with graphic presentations of the curve matching

procedures, will be provided in the Addendum to the Ground Water Monitoring Plan.

A ground water contour map for the site will be prepared using the ground water elevations calculated from the static water levels. The ground water flow direction beneath the site will be determined based on the ground water contour map. The hydraulic gradient for the site will be calculated from the ground water contour map and, in conjunction with the hydraulic conductivity, will be used to calculate the ground water flow velocity beneath the site. This information and associated calculations will also be presented in the Addendum to the Ground Water Monitoring Plan.

If the monitoring wells are screened within bedrock, dye trace testing may be required to determine ground water flow paths and velocities within the karstic bedrock beneath the site. A dye-trace analysis of the site would take approximately two months to complete. In the event that a dye-trace analysis is required, a work plan will be prepared and presented to the VADEQ for review and approval.

3.0

GROUND WATER SAMPLING

All ground water sampling will be conducted in accordance with the RAAP Sampling and Analysis Plan (SAP) for ground water sampling, which is included as **Appendix A** of this Plan. The SAP describes in detail the protocols that will be followed for: static water level measurement; monitoring well purging; disposition of purge water; decontamination of sampling equipment; sample collection, tracking, handling and shipment; and field and laboratory QA/QC procedures.

3.1

GROUND WATER MONITORING PARAMETERS

The first year of the ground water monitoring program for the Incinerator Spray Pond will involve quarterly sampling of the initial five monitoring wells to determine background concentrations. As specified in VHWMR § 9.5.C., the Detection Monitoring Program for the Incinerator Spray Pond will include quarterly monitoring for the first year for the Indicator Parameters of Ground Water Contamination, the Ground Water Quality Parameters, and the EPA Interim Primary Drinking Water Standards. The complete parameter lists are presented in **Table 1**.

In addition, the sampling program for the five wells will include monitoring for known hazardous waste constituents which are reasonably expected to be in or derived from the hazardous waste that has been contained in the Incinerator Spray Pond. The ground water samples will be analyzed for these hazardous constituents of concern on a quarterly basis to identify additional contaminants that may be present and used to demonstrate clean closure. The hazardous constituents of concern are presented in **Table 2**.

3.2

GROUND WATER SAMPLING FREQUENCY

The first year of ground water monitoring at the subject facility will involve quarterly monitoring of the initial five wells to determine background concentrations of the parameters listed in **Tables 1 and 2**. After the first year, ground water samples will be collected from the final four wells and analyzed for Ground Water Quality Parameters at least annually. Ground water samples will be collected and analyzed for Indicator Parameters of Ground Water Contamination at least semi-annually with at least four (4) replicate measurements on each sample, pursuant to VHWMR § 9.5.C.4. The elevation of the static water level in

Table 1
Detection Monitoring Program
Ground Water Monitoring Parameter List

Parameter	SW-846 Method	Recommended Container	Preservative	Holding Time	MCL (µg/L)	PQL (µg/L)	MDL (µg/L)
Indicator Parameters of Ground Water Contamination							
pH	9040	T, P, G	Field Determined	None		na	
Spec. Cond.	9050	T, P, G	Field Determined	None		na	
TOC	9060	G, amber, T-lined cap	Cool 4°C, HCL to pH<2	28 days		1,000	
TOX	9020A	G, amber, T-lined septa or caps	Cool 4°C, 1 ml of 1.1 M sodium sulfite	7 days		5	
Ground Water Quality Parameters							
Chloride	9250	T, P, G	Cool 4°C	28 days		na	
Iron	6010	T, P	HNO ₃ to pH<2	6 months			7
Manganese	6010	T, P	HNO ₃ to pH<2	6 months			2
Sodium	6010	T, P	HNO ₃ to pH<2	6 months			29
Phenols (total)	9065	G	Cool 4°C, H ₂ SO ₄ to pH<2	28 days			
Sulfate	9035	T, P, G	Cool 4°C	28 days		na	

Notes: MCL - Maximum Concentration Limit (VHWMR Table 10.5-1); PQL - Practical Quantitation Limit; MDL - Method Detection Limit

Recommended Containers: T - Fluorocarbon Resins (PTFE, Teflon[®], FEP, PFA, etc.); P - Plastic (polyethylene);
 G - Glass; PP - Polypropylene

Table 1 (continued)
Detection Monitoring Program
Ground Water Monitoring Parameter List

Parameter	SW-846 Method	Recommended Container	Preservative	Holding Time	MCL (µg/L)	PQL (µg/L)	MDL (µg/L)
EPA Interim Primary Drinking Water Standards							
Arsenic	7060	T, P	<u>Total Metals</u>	6 months	50		1
Barium	6010	T, P	HNO ₃ to pH<2		1,000		2
Cadmium	7131	T, P			10		0.1
Chromium	7191	T, P	<u>Dissolved Metals</u>	6 months	50	1	1
Lead	7421	T, P	1. Field filtered		50	1	
Mercury	7470	T, P	(0.45 micron filter)		2		0.2
Selenium	7740	T, P	2. HNO ₃ to pH<2		10		2
Silver	6010	Dark Bottle			50		7
Fluoride	340.2	T, P	Cool 4°C	28 days		na	
Nitrate (as N)	9200	T, P, G	Cool 4°C, H ₂ SO ₄ to pH<2	14 days		na	
Endrin	8080	T, G	Cool 4°C	7 days	0.2	60	6
Lindane	8080	T, G	Cool 4°C	7 days	4	40	4
Methoxychlor	8080	T, G	Cool 4°C	7 days	100	1.7	0.176
Toxaphene	8080	T, G	Cool 4°C	7 days	5	2.4	0.24
2,4 D	8150A	T, G	Cool 4°C	7 days	100	12	1.2
2,4,5 TP Silvex	8150A	T, G	Cool 4°C	7 days	10	1.7	0.17
Radium	9320	P, G	HNO ₃ to pH<2	6 months		na	
Gross Alpha	9310	P, G	HNO ₃ to pH<2	6 months		na	
Gross Beta	9310	P, G	HNO ₃ to pH<2	6 months		na	
Coliform Bact.	9131	PP, G (sterilized)	Cool 4°C	6 hours		na	

Notes: MCL - Maximum Concentration Limit (VHWMR Table 10.5-1); PQL - Practical Quantitation Limit; MDL - Method Detection Limit

Recommended Containers: T - Fluorocarbon Resins (PTFE, Teflon®, FEP, PFA, etc.); P - Plastic (polyethylene);
 G - Glass; PP - Polypropylene

Table 2
Clean Closure Demonstration
Ground Water Monitoring Parameter List

Parameter	SW-846 Method	Recommended Container	Preservative	Holding Time	MCL (µg/L)	PQL (µg/L)	MDL (µg/L)
Hazardous Constituents of Concern							
2,4-Dinitrotoluene	8090	G	Cool 4°C, Na ₂ S ₂ O ₃	7/40 days	NL	0.2	0.02
2,6-Dinitrotoluene	8090	G	Cool 4°C, Na ₂ S ₂ O ₃	7/40 days	NL	0.1	0.01
Di-n-butylphthalate	8060	G	Cool 4°C, Na ₂ S ₂ O ₃	7/40 days	NL	3.6	0.36
Diethylphthalate	8060	G	Cool 4°C, Na ₂ S ₂ O ₃	7/40 days	NL	5	0.49
Resorcinol	8270	G	Cool 4°C, Na ₂ S ₂ O ₃	7/40 days	NL	100	
Antimony	7041	T, P	<u>Total Metals</u>	6 months	6		3
Arsenic	7060	T, P	HNO ₃ to pH<2		50		1
Barium	6010	T, P			1,000		2
Beryllium	7091	T, P	<u>Dissolved Metals</u>	6 months	NL		0.2
Cadmium	7131	T, P	1. Field filtered		10		0.1
Chromium	7191	T, P	(0.45 micron filter)		50		1
Lead	7421	T, P	2. HNO ₃ to pH<2		50		1
Mercury	7470	T, P			2		0.2
Nickel	6010	T, P			NL		15
Silver	7761	T, P			50		10
Thallium	7841	T, P			NL		1

Notes: MCL - Maximum Concentration Limit (VHWMR Table 10.5-1); PQL - Practical Quantitation Limit; MDL - Method Detection Limit

Recommended Containers: T - Fluorocarbon Resins (PTFE, Teflon[®], FEP, PFA, etc.); P - Plastic (polyethylene); G - Glass

each monitoring well will be determined each time a sample is obtained. The Detection Ground Water Monitoring Program will continue in accordance with VHWMR § 9.5 until clean closure is achieved for both soils and ground water, or a ground water quality assessment monitoring program is triggered, or until the end of any required post-closure care period. If the Detection Ground Water Monitoring Program indicates that a plume may have been released from the Incinerator Spray Pond, then RAAP will submit a Ground Water Quality Assessment Plan to address whether hazardous waste constituents have been released from the Incinerator Spray Pond, pursuant to VHWMR § 9.5.D.4.

3.3

STATISTICAL EVALUATION OF GROUND WATER MONITORING DATA

VHWMR § 9.5.D.2. specifies that a Student's t-test at the 0.01 level of significance should be used to evaluate the analytical data. However, the USEPA RCRA Ground Water Monitoring Technical Enforcement Guidance Document recommends the Averaged Replicate (AR) t-test. Since the publication of the above referenced regulations and guidance, the EPA has issued "A Ground Water Information Tracking System with Statistical Analysis Capability" (GRITS/STAT). This software package has been approved and recommended by EPA Region III and VADEQ. Therefore, RAAP will use the GRITS/STAT software package at the 0.01 level of significance to determine whether or not there is statistically significant evidence of a release from the subject unit.

3.4

REPORTING REQUIREMENTS

In accordance with VHWMR § 9.5.E.1.b., RAAP will report the concentrations or values of the parameters for each ground water monitoring well to the Director within 15 days after completing each quarterly analysis during the first year when initial background concentrations are being established. RAAP will separately identify for each monitoring well any parameters whose concentration or value has been found to exceed the Maximum Contaminant Levels of the EPA Interim Primary Drinking Water Standards (40 CFR 265, Appendix III), except turbidity.

After the first four (4) quarters of data have been collected and statistically analyzed in accordance with VHWMR §§ 9.5.C. and 9.5.D., RAAP will submit to the Director the initial background concentrations or values for all parameters specified in § 9.5.C.2. and in RAAP's Incinerator Spray Pond Ground Water Monitoring List.

Following the first year in which the initial background concentrations have been established, RAAP will submit to the Director an Annual Ground Water Monitoring Report (AGWMR), in accordance with VHWMR § 9.5.E., by no later than March 1.

RAAP will determine whether a statistically significant increase (or pH decrease) of the indicator parameters has occurred on a semi-annual basis, and whether a statistically significant increase of the clean closure constituents has occurred on a quarterly basis. If a statistically significant increase is indicated, RAAP will report to the VADEQ within 7 days of the date of the confirmation, in accordance with VHWMR § 9.5.D.4.a.

If a statistically significant increase (or pH decrease) is indicated, then a Ground Water Quality Assessment Plan (GWQAP) will be implemented. This program will determine whether hazardous waste or hazardous waste constituents have entered the ground water, the rate and extent of migrations of hazardous waste or hazardous waste constituents, and their concentrations in the ground water. An outline of what would be included in such a plan, in accordance with VHWMR § 9.5.D.1. and Chapter Six of the USEPA RCRA Ground Water Monitoring Technical Enforcement Guidance Document, is presented below.

Ground Water Quality Assessment Plan

- 1.0 Introduction
 - 1.1 Objective
 - 1.2 Summary of Previous Investigations
- 2.0 Description of Incinerator Spray Pond
 - 2.1 Site Description
 - 2.2 Site Geology
 - 2.3 Site Hydrogeology
- 3.0 Characterization of Contamination
 - 3.1 Assessment Monitoring Program
 - 3.2 Ground Water Monitoring Well Network
 - 3.3 Ground Water Sampling Parameters
 - 3.4 Sampling and Analysis Procedures
- 4.0 Delineation of Constituent Plume(s)
- 5.0 Plan Recommendations

This Ground Water Monitoring Program for the Incinerator Spray Pond is to be incorporated into the Closure, Contingent Closure, and Contingent Post-Closure Plan written for the above referenced site. The time schedules, performance standards, field quality control, certification of closure, and Risk/Health-based closure options are applicable to this Plan.

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Appendix A
RAAP Sampling and Analysis
Plan

Groundwater Sampling and Analysis Plan

Radford Army Ammunition Plant
Radford, Virginia

Prepared By: Environmental Resources Management
For

Alliant Techsystems Inc.
Radford Army Ammunition Plant
Radford, Virginia

Updated June, 1995

Abstract

The geology and hydrology at the Radford Army Ammunition Plant (RAAP) is very complex and complicated. The groundwater monitoring program at RAAP is extensive and diverse. In accordance with this program, this Sampling and Analysis Plan is a working document. This S&A Plan is continually being reviewed in order to maintain its inherent effectiveness and regulatory compliance. The S&A Plan is a complete document as well as a supplement to the associated RCRA permits and applications. This plan provides guidance and procedures in many areas concerning groundwater sampling. These areas include topics such as sampling order, sampling techniques, chain-of-custody programs, equipment requirements, preservation of samples, sample handling, parameter lists and sampling sites.

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I. Introduction

This Sampling and Analysis Plan (S&A Plan) is for utilization in the groundwater monitoring program at the Radford Army Ammunition Plant (RAAP). This document meets the groundwater sampling and analysis plan requirement of Federal Regulation 40 CFR Part 265, Subpart F, Section 265.92. This S&A Plan is based on the USEPA SW846 and the RCRA Groundwater Monitoring Technical Enforcement Guidance Document (TEGD) procedures and techniques for sample collection, sample preservation and handling (shipment) chain-of-custody control, analytical procedures and field and laboratory quality assurance/quality control (QA/QC). The Well Parameter Study (11/93) is incorporated into this plan.

II. Sample Collection

Sample collection procedures govern all the activities in the field up to sample preservation. This section contains several initial activities that are significant in maintaining the integrity of the sample and data. These include measurement of static water level, detection of immiscible layers, well evacuation, sample withdrawal, and field analysis.

Prior to all sampling activities, plastic sheeting will be placed around each well to protect the sampling equipment from coming in contact with contamination, if any, around the well head and to facilitate the collection of spilled purge water as recommended by the TEGD.

1. Measurement of Static Water Level.

The measurement of the static water level measurement should be performed in each well at the site prior to each sampling event. The total depth of the well should be measured at this time also. This information is used in the calculation of purge water volume as well as assisting in determining if the horizontal and vertical flow gradients have changed since initial site characterization and/or prior sampling events.

The field crew utilizes well log information (well depth, top of screen depth, and screen length) to assist in the water level measurements. The measurements are taken with an electronic water level probe. The probe is decontaminated with an alconox soap followed by a HCL, isopropanol and deionized water rinses. The probe is then lowered into the well and the measurements (water level and total depth) are made to the nearest 0.01 foot. The permanent reference point is the top of the casing. To determine the desired value of depth to water from ground surface, the length of casing is measured and subtracted

from the depth to water from the top of casing. Any changes in length of casing measurement (i.e. modification of well pad or apron) should be noted and corrected. The same value for length of casing above ground should be used each time the water level is measured in the well. Any damage to well or well casing should be noted at this time.

2. Detection of Immiscible Layers

The detection of immiscible layers (i.e., LNAPLS and DNAPLS) is an important process in waste management. These two types of liquids can provide valuable information concerning types of existing contamination within the monitored aquifer. This detection requires specialized equipment such as a flame ionization detector (FID) or a photoionization detector (PID) organic vapor analyzer, interface probe, and a modified bailer as well as sample collection prior to well purging.

In the event immiscible layers are suspected the air in the well head should be sampled with a FID. The static liquid level should be detected by a manometer. The interface probe will then be lowered into the well to determine the presence of any immiscible layer(s). The probe will register the depths of light and/or dense liquid as well as the water level.

The collection of varying layers requires modifying the teflon bailer. For the light phase immiscible, the bailer should be slowly lowered until contact is made with the air and light phase liquid interface. The bailer should then be lowered to a depth that is less than the immiscible/water interface depth as determined by the preliminary interface probe measurements. This collection method works best with immiscible layers of two (2) feet or greater thickness. If the layer is less than two (2) feet thick but the depth to the surface of the light phase layer is less than 25 feet use a peristaltic pump. However, due to lack of a peristaltic pump, a modified bailer can be used. The bailer should have the bottom check valve sealed with plastic sheeting and the top check valve removed to allow the sample to enter the top. A bottom check valve bailer without the top check valve can be used if the modification is performed on the bottom check valve. To compensate for buoyancy of the bailer a section of one-inch stainless steel pipe can be placed on the retrieval line. The bailer should be lowered carefully to the depths indicated from the preliminary measurements. The target sampling depth is to lower the bailer to one-half thickness of the floating layer and collect the sample.

The dense phase immiscibles are to be collected with a double check valve bailer. The bailer should be lowered and raised in a slow controlled method. Decontamination procedures should be performed after collection of sample.

3. Well Purging

The stagnant water within the casing may not be representative of the in-situ groundwater quality. The well needs to have this stagnant water removed so that formation water can be sampled. The volume to be evacuated is three (3) times the combined volume of the well casing and the filter pack. The goal is

to ensure that all of the stagnant water is replaced with fresh formation water upon completion of the process. The majority of the monitoring wells at RAAP have a medium to high yield so that purging is performed above the screen in the uppermost part of the water column. The pump placement is approximately five (5) feet below the surface of water in the well. In the event a well has a low yield, then pumpings should occur near the bottom of the screened interval.

The purge volumes are based on the following calculations:

1. For water above the top of the sand pack.

$$3 \times [(11r_b^2h_s - 11r_c^2h_s) \times 0.3 + (11r_c^2h_w)]$$

2. For water below the top of the sand pack.

$$3 \times [(11r_b^2h_w - 11r_c^2h_w) \times 0.3 + (11r_c^2h_w)]$$

Where: r_b = radius of boring
 r_c = radius of casing
 h_s = height of sand
 h_w = height of water

This calculation has been performed for each well that is monitored on plant. The calculation has been revised to allow for field use. The field log sheets for individual wells have the calculation represented in the format so that the volumes of the purge water for the well casing and filter sand pack can be derived from the known information and the measured static water level. In the event that the well has a low yield, then the well can be pumped to dryness if dryness occurs prior to pumping the required volumes. However, pumping until well is dry should not occur if formation water begins to actively cascade down the sides of the well screen. This action causes an accelerated loss of volatile organic compounds (VOCs).

The purge pump used at RAAP is a Keck centrifugal 2" submersible pump. The pump has a variable speed control to allow for variable pumping rates. The pumping rate is less than 100 mL/m to 4 GPM. The pump and tubing are on an aluminum reel and frame. The pump is powered by a battery or off of the sampling vehicle.

After the static water level measurements are made for all wells within the sampling site, the purge volume calculations are made for the well to be sampled. The pump and tubing has been decontaminated prior to using at this site. In the event that the prior sampling event had occurred longer than the day before, the pump and tubing will be decontaminated by the following procedures prior to purging the well.

A sufficient amount of tubing is to be reeled out with the pump and laid down on plastic sheeting. Initially the length of tubing should be thirty feet. The pump and tubing should then be laid in the decontamination trough, which drains to the 32 gallon plastic garbage cans and be decontaminated as follows:

- * Wash equipment with Alconox soap.
- * Rinse equipment with deionized water.
- * Rinse equipment with 0.1N HCL.
- * Rinse equipment with deionized water.
- * Rinse equipment with isopropanol.
- * Rinse equipment with deionized water (USATHAMA approved water).

The pump and tubing is reeled back onto the hose reel at five foot intervals from the decontamination trough. The decontamination is performed in the trough so that the decontamination solutions are captured in the plastic garbage cans.

After the exterior of the pump and tubing is decontaminated, the interior of the tubing and the pump is decontaminated. The pump is placed in an approximately four foot long section of two inch PVC casing which is capped at one end. The decontamination solutions mentioned above are now individually poured and pumped from this PVC container through the pump and tubing and is collected with the other decontamination solutions.

The pump and tubing are allowed to air dry when possible, if not then clean wipes are used to dry the equipment. When the equipment is dry, the pump is lowered into the well and set at approximately four feet below static water level. The purging of the well casing begins and the prior calculated volumes are monitored by use of a five gallon bucket. When the bucket is full, it is emptied into one of the 32 gallon plastic garbage cans. The pH meter and conductivity meter have been calibrated in the plant laboratory prior to field use. The purge water is monitored for pH, specific conductance, and temperature. An organic vapor analyzer is utilized to screen the purge water in the event that immiscible layer liquid testing was not warranted. All purge water is collected in 32 gallon plastic garbage cans. These containers are later emptied into the Biological Wastewater Treatment Plant at RAAP.

4. Sample Withdrawal

Sample withdrawal methods are selected based upon individual wells and parameters to be analyzed in the sample. The integrity of the sample is important so it is necessary to minimize physical altering or chemically contaminating the sample during the withdrawal process. In order to reduce the possibility of sample contamination, RAAP will use teflon or stainless steel sampling devices, use dedicated samplers for each well, decontaminate non-dedicated sampling equipment, and utilize equipment blanks on non-dedicated equipment.

The monitoring program at RAAP covers a wide variety of parameters. Therefore a sampling order is established. The order will be based on the order of the volatilization sensitivity of the parameters. This sampling order is as follows:

- * Volatile organic compounds (VOC)
- * Total organic halogens (TOX)
- * Total organic carbon (TOC)
- * Extractable organics
- * Total metals
- * Dissolved metals
- * Phenols
- * Cyanide
- * Sulfate and chloride
- * Turbidity
- * Nitrate and ammonia
- * Radionuclides
- * Others (coliform, etc.)

This order is not inclusive of all parameters in that the sampling parameters do vary from individual sites. The VOCs, TOXs, and TOCs are pumped at the less than 100 mL/min rate in order to minimize volatilization. The Keck pump is used for sampling all of the parameters. Also, the pump would be used at a slightly lower pumping rate for sampling than for purging.

The sampling order will be maintained by placement of the sample containers in that order. The sample containers will be filled to overflowing so that no headspace remains. This is important to prevent loss of volatile contaminants and to prevent chemistry changes due to either CO₂ loss with pH increase or oxygenation of the sample. All crew members will wear clean latex gloves during sampling as well as purging the wells.

5. Field Analysis

Field analysis is performed on several parameters. These parameters are pH, temperature and specific conductance. Specific conductance can be performed in the laboratory if necessary. This field testing is performed on field samples (purge water) not in-situ (bore hole) samples. Therefore, contamination of laboratory samples from analysis is eliminated. Calibration of field test equipment is performed according to manufacturer's guidelines and USEPA SW-846. Field test equipment is rinsed with deionized water prior to each use. Cleaning the equipment with HCL and/or HNO₃ is performed in accordance with manufacturer's guidelines.

The pH meter is used to test four portions of the sample. The meter is standardized with two buffer solutions either pH 4.0 and 7.0 or 7.0 and 9.0. RAAP generally uses 7.0 and 9.0 solutions. The buffer solutions should be placed into 150 ml beakers for measurement. The buffer level should cover the

submerged electrode at least one-inch. If the pH measurement of the buffer solutions do not coincide with the known values, the instrument needs adjustment or the buffer solution has been contaminated and requires replacement.

To test the sample for pH, the following procedure is to be followed:

1. Pour a portion of the unfiltered sample into four clean 150 ml beakers;
2. Measure and record the temperature on the field data log sheet;
3. Measure and record the pHs;*
4. If any of the four pH measurements differ from the others by more than 0.3 pH units perform the measurements again using new sample portions in different beakers.

* The pH electrodes should be rinsed with distilled water from a squeeze bottle. The electrodes should then be blotted dry. If the sample is oily, then an isopropanol rinse should precede the distilled water rinse.

6. Sample Preservation and Handling

The groundwater monitoring program at RAAP is extensive in the variety of monitoring parameters. The monitoring program includes such parameters as volatile organic compounds, metals, organic phenols and explosives. Some of these chemical constituents and physiochemical parameters are not chemically stable and sample preservation is required. Additionally the sample containers to be used are parameter specific. Both the appropriate container and preservation methods selected to be included in the monitoring program are from SW-846. This S&A plan will specify the sample container and preservation method that will be employed in the monitoring program. Techniques for handling of the samples will also be detailed.

The sample containers will be chosen based on the sample parameter. The sample containers will be supplied by the contract laboratory utilized by RAAP. The containers are new and not reused. When metals are the sampled parameters fluorocarbon resin or polyethylene containers with polypropylene lids will be used. This container selection is based on SW-846 method 7000 test series. The sampling containers for VOCs, TOX, TOC, and other organics are amber or clear glass with fluorocarbon resin-lined lids. This container selection is based upon SW-846 method 8000 and 9000 test series. The containers are sealed and stored in a clean environment. The containers are inspected in the laboratory and the field prior to sampling.

Sample preservation is necessary for the following reasons: 1) retard biological actions, 2) retard hydrolysis and 3) reduce sorption effects. The methods utilized in the groundwater monitoring program are pH control, chemical addition, refrigeration and protection from light. The appropriate preservation method is illustrated in Table 6-1 (after TEGD and SW-846). Preservation requirements will be stated on the individual containers.

Table 6.1 Sampling and Preservation Procedures(after TEGD)

PARAMETER	RECOMMENDED CONTAINER ^b	PRESERVATIVE	MAXIMUM HOLDING TIME	MINIMUM VOLUME REQUIRED FOR ANALYSIS
INDICATORS OF GROUND-WATER CONTAMINATION ^c				
pH	T, P, G	Field determined	None	25 ml
Specific conductance	T, P, G	Field determined	None	100 ml
TOC	G, amber, T-lined cap ^e	Cool 4°C, ^d HCl to pH <2	28 days	4 x 15 ml
TOX	G, amber, T-lined septa or caps	Cool 4°C, add 1 ml of 1.1M sodium sulfate	7 days	4 x 15 ml
GROUND-WATER QUALITY CHARACTERISTICS				
Chloride	T, P, G,	4°C	28 days	50 ml
Iron Manganese Sodium	T, P	Field acidified to pH <2 with HNO ₃	6 months	200 ml
Phenols	G	4°C/H ₂ SO ₄ to pH <2	28 days	500 ml
Sulfate	T, P, G	Cool, 4°C	28 days	50 ml
EPA INTERIM DRINKING WATER CHARACTERISTICS				
Arsenic Barium Cadmium Chromium	T, P	<u>Total Metals</u> Field acidified to pH <2 with HNO ₃	6 months	1.000 ml
Lead Mercury Selenium		<u>Dissolved Metals</u> 1. Field filtration (0.45 micron)	6 months	1.000 ml
Silver	Dark Bottle	2. Acidify to pH <2 with HNO ₃		
Fluoride	T, P	Cool, 4°C	28 days	300 ml
Nitrate/Nitrite	T, P, G	4°C/H ₂ SO ₄ to pH <2	14 days	1.000 ml
Endrin Lindane Methoxychlor Toxaphene 2,4 D 2,4,5 TP Silver	T, G	Cool, 4°C	7 days	2.000 ml
Radium Gross Alpha Gross Beta	P, G	Field acidified to pH <2 with HNO ₃	6 months	1 gallon
Coliform bacteria	PP, G (sterilized)	Cool, 4°C	6 hours	200 ml

Table 6.1 Continued

PARAMETER	RECOMMENDED CONTAINER ^b	PRESERVATIVE	MAXIMUM HOLDING TIME	MINIMUM VOLUME REQUIRED FOR ANALYSIS
OTHER GROUND-WATER CHARACTERISTICS OF INTEREST				
Cyanide	P, G	Cool, 4°C, NaOH to pH >12. 0.6 g ascorbic acid ^f	14 days ^g	500 ml
Oil and Grease	G only	Cool, 4°C H ₂ SO ₄ to pH <2	28 days	200 ml
Semivolatile, nonvolatile organics	T, G	Cool, 4°C	14 days	60 ml
Volatiles	G, T-lined	Cool, 4°C	14 days	60 ml

^aReferences: Test Methods for Evaluating Solid Waste - Physical/Chemical Methods, SW-846 (2nd edition, 1992).

Methods for Chemical Analysis of Water and Wastes, EPA-600/4-79-020.
Standard Methods for the Examination of Water and Wastewater, 16th edition (1985).

^bContainer Types:

P = Plastic (polyethylene)

G = Glass

T = Fluorocarbon resins (PTFE, Teflon, EFP, PFA, etc.)

PP = Polypropylene

^cBased on the requirements for detection monitoring (40 CFR 265.93) the owner/operator must collect a sufficient volume of groundwater to allow for the analysis of four separate replicates.

^dShipping containers (cooling chest with ice or ice pack) should be certified as to the 4°C temperature at time of sample placement into these containers. Preservation of samples requires that the temperature of collected samples be adjusted to the 4°C immediately after collection. Shipping coolers must be at 4°C and maintained at 4°C upon placement of sample and during shipment. Maximum-minimum thermometers are to be placed into the shipping chest to record temperature history. Chain-of-custody forms will have Shipping/Receiving and In-transit (max/min) temperature boxes for recording data and verification.

^eDo not allow any head space in the container.

^fUse ascorbic acid only in the presence of oxidizing agents.

^gMaximum holding time is 24 hours when sulfide is present. Optionally all samples may be tested with lead acetate paper before the pH adjustment in order to determine if sulfide is present. If sulfide is present it can be removed by addition of cadmium nitrate powder until a negative spot test is obtained. The sample is filtered and then NaOH is added to pH 12.

The groundwater monitoring program requires some special handling considerations. Initially, the samples should not be transferred to another container due to loss of analyte and volatilization. The VOCs, TOX, and TOC containers should be slowly filled to eliminate any headspace within the container. Any headspace remaining in these containers should be noted in the logbook. Additional handling considerations relate to the metal analysis samples. Particles within the well can adsorb or adsorb various metallic ion species. Therefore the groundwater samples on which metals analysis is to be conducted should consist of two portions. One portion should be filtered through 0.45 micron membrane filter (Millipore Filter System). This portion should be preserved according to the following AEHA procedures:

The filtration procedure is performed with the "Millipore Hazardous Waste Filtration System." It uses compressed nitrogen instead of a vacuum pump. Large volumes can be filtered in a relatively short time period with this system. A 0.45 micron filter shall be used for filtering samples used for metals analysis. This system also uses the membrane filters and prefilters only they are much larger than those with the vacuum system because of the larger filtration surface area. The membrane filters must be soaked in distilled water for 24 hours prior to using. They should also be handled only with the purchased forceps, never with one's fingers. Care must be exercised when handling the membrane filter to avoid making any tears or pin holes. Before a sample bottle is filled with a filtered sample, it should be rinsed once with a small amount of the filtered sample and then that portion discarded. Sample bottles should not be rinsed or cleaned in any other manner because they will have been appropriately cleaned prior to shipment. Smaller containers should be filled before the large 1-gallon cubitainer for radiochemistry parameters. All containers should be filled to nearly full, but not overflowing because preservative must be added to some. The samples for each site being monitored should be filtered beginning with the upgradient well(s) to minimize the possibility of cross contamination problems. The filtering apparatus should be cleaned between samples.

Additional handling consideration will be to cool the samples by ice while the samples are in the field or immediate transport to the Water Lab for refrigeration. The sample coolers will be transported to the plant laboratory for processing when sampling is completed at the individual well. The metals filtering and additional cooling will be performed at the laboratory. RAAP will use minimum and maximum thermometers at random intervals to verify that the samples are maintained at 4°C during the sampling and transporting phases of the monitoring program.

7. Chain-of-Custody Documentation

The groundwater monitoring program incorporates a chain-of-custody program to track the route and handlers of the groundwater samples. The monitoring of sample possession from field sampling to laboratory analysis is important in the event that unexpected lab results occur and the security of transportation

is evaluated. This documentation contains several records and logs that assist in the quality control of the program.

Sample labels are used to prevent misidentification of samples. The labels are filled and affixed to the sample containers prior to field sampling. The labels contain the following information:

- * Sample identification number
- * Name of sampler (initials)
- * Date and time of sample collection
- * Sampling location
- * Parameters to be analyzed

Sample seals should be used when a common carrier transports the sample shipment to the laboratory. These seals ensure that the samples have not been disturbed during transportation. The sample identification and date will be included on the sample seal.

A Field Log Sheet is utilized to record the field information at each well site (as shown in Figure 7.1). This sheet incorporates the purge rate volume calculations for each respective well. The field data log sheet includes the following information:

- * well identification
- * static water level measurement and equipment used
- * presence of immiscible layers noted
- * reference point for static water level measurements
- * purge volume and pumping rate
- * well yield comments
- * well purging (evacuation) procedure, time, and equipment
- * well sampling date, time, and equipment
- * sample identifications (by parameters)
- * preservative used
- * parameters to be analyzed
- * field measurements: pH (4), T, C, and conductivity
- * headspace in containers review
- * time and meters used in field analysis
- * sample preparation date, time, and filtering method
- * sampler's and sample preparer's names

The chain-of-custody record is filled out for each site and accompanies the samples to the contract laboratory. The completed form is returned to RAAP with the analysis for each site. This record is shown in Figure 7.2. The sample possession is established from time of collection to the time of analysis. This record contains the following information:

- * sample identification and location
- * signature of sampler
- * date and time of sampling
- * sample type
- * well identification
- * number of containers
- * required analysis
- * signature of person(s) involved in possession
- * times and dates of possession
- * method of transportation
- * statement for packing on ice
- * temperature during shipment (min & max)
- * internal temperature upon arrival at laboratory

A sample analysis request sheet can further clarify the samples for each requested parameter. This additional check sheet will be utilized when necessary (i.e., beginning of a new contract with a new laboratory). This sheet sent along with the samples will contain the following information:

- * name of person receiving samples
- * laboratory sample number
- * date of sample receipt
- * analysis to be performed
- * internal temperature during shipping

The contract laboratory will keep a log book to document the processing steps that are applied to the sample. All sample preparation techniques and instrumental methods must be identified in this log book. The results of the analysis of all quality control samples should be identified specific to each batch of groundwater samples analyzed. The log book should also include the time, date, and name of person who performed each processing step.

8. Analytical Procedures

As mentioned previously the groundwater monitoring program at RAAP is very extensive. The program consists of nine sites and 80 sampled groundwater monitoring wells. An additional 14 observation wells are monitored each quarter. The respective wells for each site are listed in Appendix III.

The EPA - SW 846 approved test methods for the analysis parameters per site are shown in Appendix I. The attachment in the Appendix I indicates the parameter, frequency, SW 846 method, and UG/L for each monitored site. The method 6D designation requires a U.S. Army test method for explosives. This method is the U.S. Army Toxics and Hazardous Materials Agency method 6D. In the event a USEPA SW-846 method is available, this method will be substituted for the USATHAMA method.

All records of analysis will be distributed to the appropriate agency as well as maintained on site.

9. Field and Laboratory Quality Assurance/Quality Control

The S&A Plan addresses the QA/QC program to ensure the reliability and validity of field and analytical laboratory data gathered as part of the overall groundwater monitoring program. The field QA/QC program consists of routine collection and analysis of trip and equipment blanks. The trip blank is filled with deionized water and handled like a groundwater sample. One trip blank each sampling day will be processed. The trip blank will be analyzed for sample parameters.

Equipment blanks will be used to monitor the decontamination of non-dedicated equipment used in the sampling process. The blank consists of filling (pumping) sample bottles with Type II reagent grade water through the sampling device, transfer to sample bottles, and return to the laboratory for analysis. Again, this blank is handled like a groundwater sample. One equipment blank every 20 samples will be used whether that sampling event occurs over one day or longer. The equipment blank will be analyzed for site-specific parameters. One field duplicate sample will also be taken for every twenty samples, whether that sampling event occurs on one day or longer.

The results of the trip and equipment blanks are used to evaluate the sampling procedures. The groundwater data will not be altered in regard to the field blanks data.

Calibration of field and laboratory equipment is performed according to manufacturer's guidelines and the more stringent U.S. Army regulations. The field pH meter is calibrated prior to each sampling event.

The contract laboratory is to provide a QA/QC plan for laboratory analysis according to USEPA SW-846. This plan utilizes standards, laboratory blanks, duplicates, batch spikes and matrix spikes for calibration and identification of potential matrix interferences. This data is on file at the laboratory and is routinely reviewed by RAAP personnel. This data is a measure of performance as well as an indicator of potential sources of cross contamination. Again, this control data is for performance review not for correction of groundwater analysis data.

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file
[Signature]

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May 31, 1995

95-815-208

Virginia Department of Environmental Quality
4900 Cox Road
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Attention: Mr. Glenn von Gonten

Subject: Response to 1994 Comprehensive Ground Water Monitoring Evaluation
(CME)

Dear Sir:

The Department of Environmental Quality's (DEQ) March 28, 1995 CME requested several improvements to the ground water monitoring program at RAAP. Enclosure 1 is a report from Environmental Resources Management (ERM). The report includes:

Schedules to complete Phase I of the Ground Water Quality Assessment Plan (GWQAP)

Discussion of monitoring wells including confirmation of wells that will cease to be monitored

Background Calculations for Site 10 (electronic media will be delivered under separate cover),

Revised Sampling and Analysis Plan (SAP) as directed by the CME.

We originally discussed, May 10, 1995, delivering Phase I of the GWQAP July 31 1995. We are requesting that the GWQAP not be delivered until August 31, 1995 so that we can research the early 1980 vintage data as you requested.

We will be monitoring the wells referenced in the CME with the exception of Site 10. As discussed, May 10, 1995, Well DDH4 was compromised by the Corps of Engineers. We will need to use Well D4 as our upgradient well. Well DG1 will be used for potentiometric evaluations.

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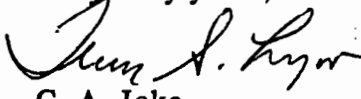
Mr. Glenn von Gonten
May 31, 1995
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There seems to be confusion on Site 10. The ERM report includes new background calculations for Site 10. RAAP monitored ground water at site 10 as far back as October 26, 1981. Background data for indicator parameters were delivered in March, 1983. On August 14, 1984 at a meeting with Howard Freeland, Virginia Department of Health, Kenneth McGill, EPA Region III, and RAAP personnel it was determined that monitoring at Site 10 was not required. Analysis of samples were delivered in Fall 1990 in conjunction with the Part B application, which was subsequently withdrawn. RAAP will continue to monitor the constituents listed in the SAP.

RAAP will begin using the revised SAP July 1, 1995. This revised plan includes the correct location of Site 4 well W2B, the monitoring lists provided March 28, 1995 for Sites 4, 10, and 16, April 20, 1995 for Sites 5 and 7, and May 7, 1993 Attachment D for Site 13.

Please direct comments or questions to Jerry Redder, Alliant Techsystems, 703-639-7536.

Very truly yours,


for C. A. Jake
Environmental Manager

/JJRedder

c: John Humphries, EPA Region III
Howard Freeland, DEQ
Leslie Romanchik, w/p enclosure DEQ

Enclosure